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EXPLORING PHARMACY STUDENTS' AWARENESS AND ATTITUDES TOWARD PHARMACOGENOMICS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Pharmacogenomics, the study of how different genes affect how the body reacts to drugs, is a cornerstone of personalised medicine. Understanding pharmacogenomics is becoming more and more important for chemists as their job shifts towards patient-centered treatment. As the healthcare industry's future leaders, pharmacy students have a responsibility to learn about pharmacogenomics and how to incorporate it into patient care.

The purpose of this survey is to find out where pharmacy students are lacking in their education by measuring their understanding of pharmacogenomics and their attitudes and perspectives towards the topic.

The researchers used a cross-sectional survey design to collect data from undergraduate pharmacy students at a single university. The survey tool included structured questions that probed participants' understanding of pharmacogenomics, their opinions on its practical use, their preparedness to use it in future positions, and their perceptions of its importance.

The findings show that most people have a decent grasp of pharmacogenomics, with a greater level of comprehension among seniors. Few students were comfortable using genetic data to inform clinical decisions, even though most understood pharmacogenomics' potential to increase medication safety and effectiveness. A sizeable minority would want to see more specialised instruction in this area.

The research concludes that pharmacy students are becoming more knowledgeable about pharmacogenomics and have a favourable outlook on its potential therapeutic applications. The results do, however, highlight the need for further educational initiatives to provide students the hands-on experience necessary to incorporate pharmacogenomics into patient treatment. Pharmacists may help fill up the gaps in our understanding of precision medicine by including organised pharmacogenomics training in their curricula.

I. INTRODUCTION

Pharmacogenomics (PGx) is a relatively new discipline that has completely altered the idea of personalised medicine by studying how people's genes impact their reactions to medications. Improved effectiveness, fewer adverse medication responses, and optimised treatment outcomes are all within reach with pharmacogenomics' promise of personalised drug therapy based on each patient's genetic composition. Healthcare providers need to be flexible and prepared to use pharmacogenomics in their practice as the field develops.

Because of their extensive knowledge of medication interactions, pharmacology, and patient counselling, chemists are in a prime position to spearhead the adoption of pharmacogenomics. Their capacity to make meaningful contributions, nevertheless, is contingent upon having a solid grounding in this dynamic field. As members of the healthcare industry's future workforce, pharmacy students have a responsibility to educate themselves on

pharmacogenomics so that they can play an active part in personalised medicine.

Research shows that many pharmacy students lack confidence in interpreting pharmacogenomic data, have gaps in their understanding, and have only been exposed to the topic in a limited way in their curriculum, despite the increasing worldwide interest in this area. Although many acknowledge its practical value and have favourable opinions about it, they often worry that they won't be able to put their newfound knowledge to use in the actual world.

Examining the extent to which present-day educational programs provide students with pharmacogenomics-related abilities is crucial in light of the fact that pharmacy education is always developing. Finding educational gaps and providing evidence for possible curriculum development are the goals of this research, which is to assess pharmacy students' knowledge, attitudes, and views of pharmacogenomics.

II. METHODOLOGY

3.1 Research Plan

This research aimed to evaluate pharmacy students' understanding, perspective, and familiarity with pharmacogenomics using a cross-sectional survey using questionnaires.

3.2 Research Environment and Subjects

Students pursuing a [Bachelor of Pharmacy/Doctor of Pharmacy] degree at an accredited university were the subjects of the research. We extended an invitation to students in their last year of university to take part because they were more likely to have taken courses that were directly relevant to the topic.

3.3 Eligibility Requirements Presently Enrolled Pharmacy Students

Third-, fourth-, and final-year students

People in the student body who gave their permission

First-year students (because of their insufficient experience to the material) are excluded based on 3.4.

Lack of participation or absence of students during data gathering

3.5 Tool for Collecting Data

Adapted from previously validated instruments, a structured, self-administered questionnaire was created to meet the research goals. It was divided into four primary parts:

Personal information (such as age and year of school)

Test Your Knowledge: 10 MCQs covering fundamental pharmacogenomics ideas

Attitude Scale—Questionnaire questions designed to gauge students' perspectives on pharmacogenomics and its practical applications in the field of pharmacy

Questions concerning students' opinions on the appropriateness of the program, their desire for more training, and their perceived preparedness to use pharmacogenomics in clinical settings make up the "perception and preparedness" section.

3.6 Methods for Collecting Data

A short introduction to the research was provided to participants at academic meetings or classroom sessions. Hard copies (or digital versions, if available) of the questionnaire were distributed. Recipients' identities were kept secret, and participation was entirely optional.

3.7: Moral Issues

The research was given the go light by the Institutional Ethics Committee.

All participants were asked to provide their informed permission.

At all times, participants' identities and data were kept secret.

3.8 Analysing the Data

After data collection, it was imported into Excel and analysed using SPSS (Statistical Package for the Social Sciences) or a comparable program.

Knowledge levels and attitude patterns were summarised using descriptive statistics, which include frequencies, percentages, and mean scores.

Associations between knowledge/attitude scores and covariates such as year of study were assessed using inferential statistics (e.g., chi-square test, ANOVA).

III. RESULTS

3.1 | Study selection

The article selection procedure is shown in Figure 1. After removing duplicates, 865 of the 1,773 papers found in the literature review had their titles and abstracts reviewed. We did not include 807 items since they did not fulfil our criteria. Out of the 58 papers that were evaluated for the full-text screening, six were not included. Full data extraction and critical evaluation were performed on 52 papers in total.

3.2 | Study characteristics

Figure 2 shows that the included research represented twenty-six different nations. With 12 and 4 research, respectively, done in the US and Canada, the next most common countries were Jordan, Saudi Arabia, Malaysia, Australia, and the UAE, each of which had 3 studies. Table 1 shows that the included studies employed a variety of techniques and took place in a variety of contexts. Pharmacists from various settings, including retail and private pharmacies, public and private hospitals, university research centres, and primary care clinics, were surveyed using convenience sample techniques in various regions or throughout the country. We sought for students from schools that offered pharmacy studies. The majority of research (n = 49) collected data on PGx-related knowledge, perception, attitude, or confidence using cross-sectional questionnaires. All three of these qualitative research relied heavily on focus groups and semistructured interviews. To determine whether there was a difference in perspectives on the clinical use of PGx and the current delivery of PGx education, the results for pharmacists and pharmacy students were presented individually. Out of the 49 studies that were considered, a grand total of 8092 pharmacists (ranging from 11 to 1303) and 4002 pharmacy students (ranging from 62 to 637), were either polled or interviewed. There were a total of 336 participants across three investigations that used pooled data from pharmacists and pharmacy students. Among the 52 studies that were considered, 12,430 individuals were either practicing pharmacists or were studying to become pharmacists.

3.3 | Synthesis of results

Data were presented and analysed descriptively according to the following criteria: pharmacists' and pharmacy students' knowledge of PGx, their attitudes and perceptions of PGx, their confidence in using and interpreting PGx testing results, and their desire for or preferred method of further PGx education (Table 1).

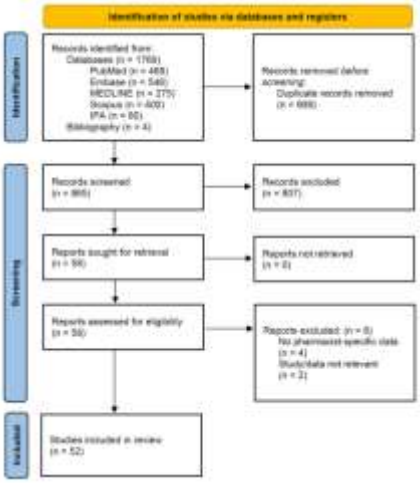

FIGURE 1 PRISMA flow diagram of the article selection process. IPA, International Pharmaceutical Abstracts; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

3.4 | Knowledge and awareness of PGx

Both practicing chemists and pharmacy students exhibited a general lack of familiarity with PGx. Table 1 shows that most studies agreed that pharmacists should be expected to have a good understanding of PGx because of its relevance to pharmacy practice. The need of chemists knowing how to order, suggest, and interpret the findings of PGx tests, as well as providing information on their proper usage, was emphasised by several responders. The numbers 35, 39, 45, 47, 48, 53, 56, 58, 59, 83, and 84 The majority of respondents had a poor or insufficient degree of PGx knowledge or awareness, according to 23 out of the 34 research that reported on this topic among chemists. 31,35–38, 41,44,46,47, 50–52, 54,55, 57,59, 60,66,67, 76, 82,83, 85 No study that was considered indicated that the majority of participants have sufficient understanding about PGx. When comparing pharmacy students, the majority of research have shown that the majority of participants had a good or acceptable level of understanding. From 69 to 81 "Low" was the commonly reported level of self-assessed (subjective) knowledge about PGx in these research. Nevertheless, research that evaluated both types of knowledge found that self-assessed knowledge did not always match real skill. 37 Although there was a lack of data on "biological sex" in several research, one did find that male and female pharmacy students had different levels of expertise. Nevertheless, the causes behind this were not thoroughly investigated. 72

IV. DISCUSSION

A recent systematic review looked at the knowledge and attitudes of medical and pharmacy students towards PGx, which included thirteen studies involving pharmacy, and an earlier one examined the attitudes of patients, general practitioners, and pharmacists in primary care, which included six studies involving pharmacists. 29 Researchers and pharmacy experts throughout the world agree that PGx is a promising new way to implement precision medicine in healthcare, according to this and earlier evaluations. But there's still a long way to go before present and future chemists are ready to embrace the "PGx expert" position as the gold standard in patient care.

There is enough information on the advantages of PGx testing in precision medicine to make pharmacists and pharmacy students feel good about using PGx in pharmacy practice, even if PGx is not presently being used in most cases. 1,122,78 $ Although some research found somewhat more conservative opinions towards PGx among certain chemists in Syria (2021 study) and Australia (2014 study)45, this impression seems to be shared internationally. Neither study distinguished between studies reporting very favourable attitudes nor those revealing somewhat more conservative views. 36 Additionally, the absence of strong clinical evidence and education over eight years ago may have impacted the results of those

investigations. 45.65 cents Pharmacists and pharmacy students were in agreement that PGx testing will increase patient safety by customising treatment strategies and preventing side effects associated with genetic variations in medication metabolism. There may be a lack of infrastructure for the inclusion of PGx testing into practice rather than a negative assessment of its applicability, given only a small number of studies stated that PGx is not relevant to their existing practice. According to earlier studies, numerous medical experts share the view that chemists should spearhead the delivery of PGx services and serve as a go-to resource for advice on when and how to employ testing. $35,48,88 dollars In 2020, Genomics England and the National Health Service Improvement revealed their intentions to introduce PGx testing within the next decade. In addition, they recognised the crucial responsibilities that chemists play in the implementation model. 90 It is now a matter of "when" and "how" pharmacists, the most approachable healthcare professionals, will integrate PGx testing into their routine practice, as numerous pharmacy groups around the globe are urging pharmacists to spearhead these implementation initiatives and prepare for the expected broad availability of inexpensive direct-to-consumer PGx tests. 91 The incorporation of PGx testing into clinical pharmacy practice is hindered by many obstacles. Some of these issues include not knowing how well it will work in the clinic, having trouble deciding who to test and when, not having enough regulations or standards, and having trouble working with the doctor who prescribed it. Patients are further inconvenienced since chemists are not always at the point of prescription, there is no automatic EMR infrastructure to detect possible PGx interactions, and patients do not have access to electronic medical records (EMR) to record PGx findings. Further complicating matters is the fact that patients bear the financial burden of testing, there is no compensation for the time chemists spend educating patients, religious or cultural values play a role, and some jurisdictions consider sample collection to be outside the scope of pharmacy practice. As a result, people are even less knowledgeable about PGx and less confident in their ability to put what they do know into practice in the absence of formal training. 27,32 Perhaps as a result of changes to pharmacy curricula to include more contemporary ideas of personalised healthcare, it seems that students were more inclined to claim a moderate to excellent degree of understanding (Table 1). Tuteja et al.,67 provide credence to this notion by finding that individuals with the most modern pharmacy degree, a Doctor of Pharmacy (PharmD), have a superior level of knowledge. This finding is in line with the fact that PGx instruction is currently more common in pharmacy schools. According to a 2019 international study, more than 82% of medical and pharmacy schools offered PGx either as an independent course or as part of the "pharmacology" curriculum. 92 The current requirement from the US Accreditation Council for Pharmacy Education is that all pharmacy schools and colleges provide PGx instruction in their degree programs. 93 Pharmacists with ten years of experience or more outperformed their less seasoned counterparts in a 2018 research out of Kuwait. 35 This seems to contradict a another research conducted in Malaysia, which indicated that chemists with less experience had a higher level of PGx understanding. This finding suggests that there may be variations in PGx education. 78 Another important obstacle to using PGx in pharmacy practice is the difference between participants' subjective knowledge and their objective knowledge. This shows that participants do not have confidence in their abilities to determine which medications need PGx testing, and then to correctly interpret, advise, and counsel on the results. 27 This overall lack of understanding of PGx was also

described by several researchers who said that they didn't know enough about the issue to make an informed decision. The majority of respondents in the Kuwait survey cited a lack of knowledge or experience as the main obstacle to putting PGx testing into action. 35 Additionally, pharmacists are hesitant to integrate PGx testing into routine patient care due to the absence of standardised PGx standards and tools for pharmacy practice. This highlights the fact that there is a lack of knowledge on the resources that are accessible for PGx. Clinical adoption is already a challenge, and there is a lack of awareness about PGx resources, such as the US FDA labelling on certain pharmaceuticals that pertains to PGx. Several of the studies that made it into this review also polled doctors, and they found that their patients had the same lack of understanding and trust in PGx that the chemists did. Improved trust and communication among healthcare professionals is crucial for delivering personalised, patient-centered care, and this emphasises the necessity for more thorough PGx education in all healthcare fields. Ideally, this will help us achieve the collaborative multidisciplinary approach we aim for in the 21st century. To better inform patients and other medical professionals about the value of PGx testing and how it may be used to provide optimal treatment, chemists need better training. 31 Table 1 shows that the majority of the publications that evaluated participants' desire for additional education on the issue of PGx reported a significant desire for future education in the form of CE. Approximately half of the articles included in this study examined this desire. Research conducted between 2012 and 2014 yielded rather encouraging results, which is consistent with the growing recognition of the importance of PGx awareness and expertise in the field. While no particular format for continuing education was requested more often, numerous articles did mention e-learning or web-based CE, which would probably be the most convenient way to give PGx instruction to working chemists on a large scale. numbers 41–64

V. CONCLUSION

Despite the advantages of employing PGx in ordinary pharmacy practice, this research indicated that there is a limited use of PGx in pharmacy practice. Pharmacists and pharmacy students worldwide firmly agree on the limits of PGx testing and the numerous hurdles to adoption. On top of that, more PGx knowledge and training is necessary. If PGx knowledge were required in pharmacy programs, the next generation of pharmacists would be ready to incorporate it into their routine patient care duties.

The primary focus of academic pharmacy schools need to be the creation of training programs for working pharmacists. These programs have to be reasonably priced, user-friendly (online or hybrid), interesting (experiential education, clinical training), and productive (certifications, continuing education credits).

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